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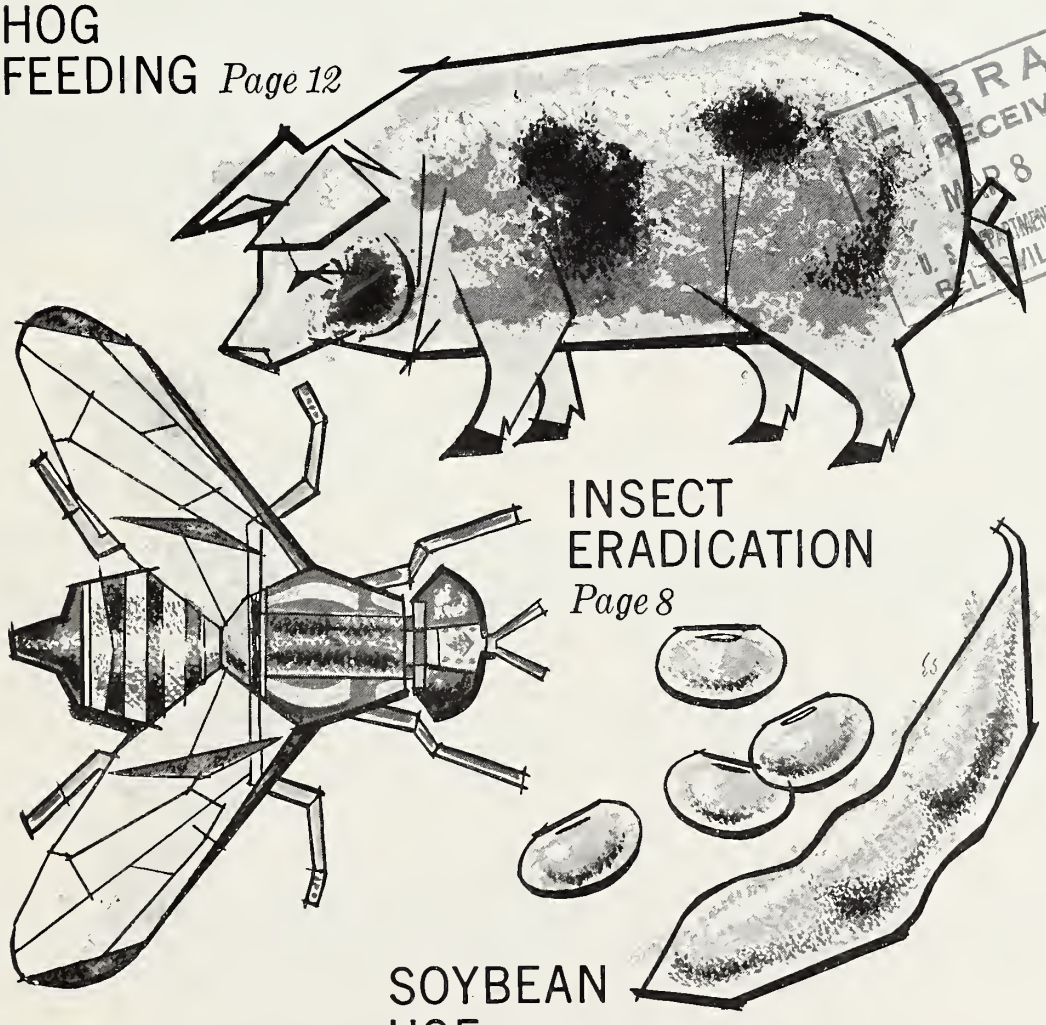
AGRICULTURAL Research

March / 1960



HOG FEEDING *Page 12*

INSECT ERADICATION *Page 8*

SOYBEAN USE *Page 5*

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AGRICULTURAL
Research

Vol. 8—March 1960—No. 9

CONTENTS

Editor: J. F. Silbaugh. Managing Editor: H. G. Hass. Contributors to this issue: E. Evers, C. E. Olsson, M. S. Peter, J. E. Pawlick, J. R. Madison, V. Bourdette, D. H. Mayberry.

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Chemicals and Foods

Our food supply in the United States is the safest, cleanest, and most wholesome in the world. USDA takes pride in the part it has played in making this true.

The Department considers that the safety of the Nation's food is its first responsibility in carrying out assignments from the Congress. This principle guides USDA research and regulatory and service activities pertaining to foods and to the use of chemicals in food production and distribution.

The Department intends to continue and intensify its efforts to insure that American consumers get the foods they need and want, in adequate quantities at a reasonable price, and that these foods continue to meet the highest standards of nutritional quality and wholesomeness. It strongly endorses the *safe* use of *carefully tested* chemicals as required to maintain the excellence, variety, and economy of the foods we eat.

We cannot continue to produce adequate amounts of safe and wholesome foods without chemicals. Abandoning their use on farms and in the food industry would result in immediate decline in the quantity and overall quality of our food supply and cause a rapid rise in food prices paid by consumers.

The use of chemicals in foods is as old as preserving meat with salt . . . and as new as adding thiamine to bread.

In every way possible, Department actions are aimed to assist growers, processors, and distributors in producing and marketing products that meet all the requirements of law regarding safety and wholesomeness. USDA is continuing today, as for many years past, to withhold approval of the use of chemicals that do not meet these requirements.

Consumers, as well as farmers and the food industry, have a vital stake in the safe use of chemicals in food production, and in the research and regulatory programs of our Federal and State governments that assure wholesome, high-quality foods in economical abundance. Only wide public understanding of these facts can provide the necessary basis for continued supply of good foods we can enjoy in safety.

(Highlights from a statement on "Chemicals and Foods" issued by Secretary of Agriculture Ezra Taft Benson.)

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Striped leaves show symptom for which hoja blanca (white leaf) was name. Infected leaves may also be mottled or completely white. Heads (panicles) of infected rice plants at far left are stunted and upright because few or no seeds develop. Uninfected heads at right show normal drooping of panicles with full seed complement.

A step ahead of HOJA BLANCA

Investigations started by our researchers in 1956 following a serious outbreak of this rice virus in Cuba have given us a headstart toward development of resistant lines

■ We made a headstart against hoja blanca, a virus disease that invaded after seriously damaging rice crops in Latin America. Cooperative research by USDA with Arkansas, California, Louisiana, and Texas Agricultural Experiment Stations began before the virus got here.

We've found sources of resistance, and there's reason to believe it can be transferred relatively soon to commercial rice. While breeding work is going on, seed of resistant varieties, including Arkrose in Arkansas and Lacrosse in Louisiana, is being increased to give stop-gap varieties in case the virus becomes epidemic.

A STEP AHEAD OF HOJA BLANCA

(Continued)

Holding cages are used at Camaguey laboratory to test infective ability of plant hoppers, to provide virus-infected rice plants for hoppers to feed on, and to test reaction of rice plants to infection.

J. U. McGuire (center) shows J. G. Atkins (left) and C. R. Adair trap used to collect plant hoppers for research and to check rice fields for presence of the plant hopper.

Seed of Gulfrose, a recently developed medium-grain rice found to be resistant, will be available to growers this year. Gulfrose was developed by ARS agronomist H. M. Beachell and co-workers in cooperation with the Rice-Pasture Experiment Station, Beaumont, Texas.

Investigation of hoja blanca was prompted by a serious outbreak in Cuba in 1956. When the virus showed up in Florida in 1957, work was already underway to test the reaction of U.S. rice varieties. And the USDA Hoja Blanca Laboratory had been set up at Camaguey, Cuba, to study the disease and its insect carrier.

Recognition of the potential threat of the virus and discovery of the disease and its carrier in Florida (AGR. RES., December 1957, p. 15) led ARS plant pest control workers to organize Federal-State surveys of the main U.S. rice-growing areas of Mississippi, Arkansas, Texas, Louisiana, and California in the following years. The disease was found on 86 acres in southern Mississippi in 1958 and about 7,000 acres in Louisiana in 1959. Regulatory agencies sprayed the areas with insecticide on a 10-day schedule during the growing season to destroy the carrier and thus minimize spread. Growers in Florida and southern Mississippi aided the control effort by discontinuing rice production temporarily.

Meanwhile, agronomist C. R. Adair and plant pathologist J. G. Atkins screened for resistance to hoja blanca over 4,000 different lines of rice, comprising all U.S. commercial varieties and selections from the USDA World Rice Collection. Since testing depended on natural infection of plants in fields where hoja blanca was known to occur, the plants were screened in field plots in Cuba and South America. The tests were made with the assistance and cooperation of W. C. Davis, Arrozal Bartes, S.A., in Cuba, and R. K. Walker, Narfarms, Inc., in Venezuela.

All U.S. long-grain varieties and most widely grown medium- and short-grain varieties were found susceptible to the disease.

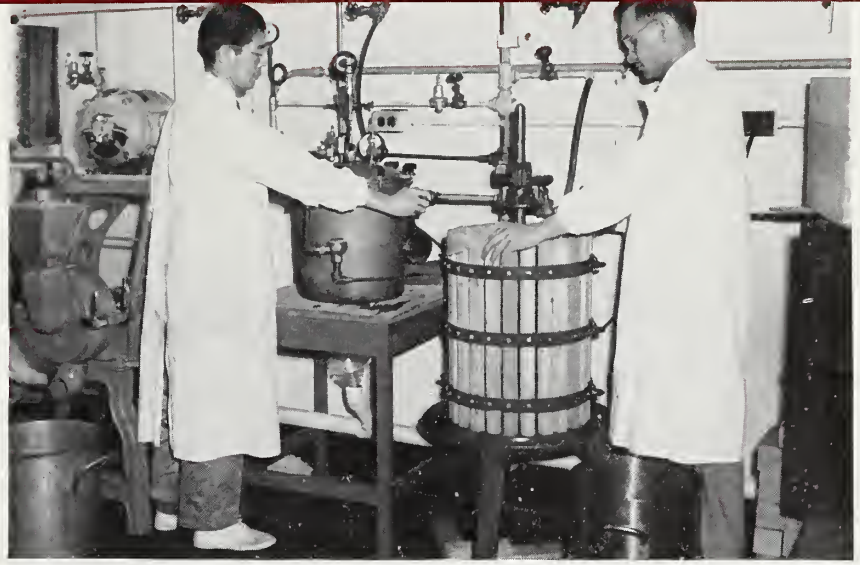
But the screening turned up a number of resistant lines usable in breeding. Crosses between such lines and commercial rice have shown that resistance as a genetic characteristic is not difficult to transfer. Many generations of breeding are, of course, necessary to develop commercially productive resistant lines.

The breeding is being accomplished also with the aid of foreign research institutions. U.S. plant breeders in rice-growing States make the necessary crosses, then send seeds to cooperators in Cuba, Colombia, Venezuela, El Salvador, and Costa Rica, where plants are grown and screened in field plots. Two crops a year can be grown in these countries, in contrast to one crop here.

ARS entomologists J. U. McGuire and W. W. McMillian and plant pathologist H. A. Lamey at Camaguey are attempting to develop a laboratory method to infect plants so screening can proceed more dependably. Studies are continuing on properties and host range of the virus and on the biology, ecology, and methods of control of the insect carrier, identified by a Cuban scientist as the plant hopper *Sogota orizicola*. In experiments thus far, the virus was not transmitted by seed, soil, or manual methods. ☆

Japan CAN Use Our Soybeans

New processing methods may help us get larger share of expanding imports



Typical Japanese equipment (left to right: wet grinder, pressure cooker, press) was used by T. Watanabe, Japan, A. M. Nash, ARS, during test preparation of tofu from U.S. beans.

■ High-quality miso and tofu—major foods in Japanese diets—have been made from American soybeans by USDA research. This could open a larger part of an expanding soybean market in that country to U.S. beans.

Japan, even though it is already short on supply, expects to increase soybean consumption 40 percent over the next 10 years in a plan to improve the population's protein intake. The traditional soybean food products account for about half of the total soybean use, and miso alone for about 20 percent of the total.

Miso, a paste, is used primarily in soup—generally eaten twice a day—to provide protein and flavor in a nearly meatless diet. Miso paste may be light to deep brown and is similar to soy sauce in flavor. Miso is traditionally made by cooking soaked soybeans for 1 to 2 hours, adding salt, water, a yeast starter, and fermented rice, and fermenting the mixture for 45 days to a year.

Crack beans, remove seed coat

Scientists working under direction of A. K. Smith and C. W. Hesseltine at the ARS Northern Utilization Research and Development Division, Peoria, Ill., studied the use of U.S. soybeans in Japanese foods. The work was part of a market-development program in cooperation with the Foreign Agricultural Service and the American Soybean Association. Hesseltine and Kazuo Shibasaki, of Tohoku University, Sendai, Japan, working on miso processing, first cracked the soybeans into grits and removed the seedcoats. This cut fermentation time about in half. Removal of the seedcoats eliminated the greatest single cause of unsuitability of some American varieties for miso production. It also reduced soaking and cooking time, removed any black hila or "eyes," which cause dark spots in the miso, and increased protein content and uniformity. Laboratory-made miso was judged equal to the Japanese product in quality.

Smith and Tokuji Watanabe, of the Japanese Ministry of Agriculture and Forestry, evaluated American soybean varieties for production of tofu. They found some varieties equal to Japanese soybeans and other varieties that might be acceptable.

Tofu, known as soybean curd, is made by soaking, wet grinding, cooking, and filtering soybeans to produce an emulsion. Calcium sulfate is added to coagulate the protein and oil. This is molded into a soft, white cake used in soup, or fried in deep fat to make "aburage," or processed to make so-called "frozen tofu."

We are now exporting an estimated 35 million bushels of soybeans a year to Japan. That's almost a ten-fold increase in the past 9 years. The Japanese use our soybeans mainly for extraction of oil. Japanese food processors have objected to using American soybeans in traditional food processes that start with whole beans on the grounds that our beans absorb water, cook, and ferment more unevenly than Japanese beans.

Japanese objections overcome

Our soybeans have been bred for characteristics other than for use in food processes that start with whole beans. The Japanese have also objected to split and broken beans, foreign matter and other crop material in our soybeans, and the color and "beany" flavor of foods made from U.S. beans. The new process for making miso developed at Peoria could overcome all but one of these objections—foreign-matter content.

Shibasaki and Watanabe are engaged in soybean-food research in Japan and were selected, with the help of the Japanese-American Soybean Institute, to work on this part of our market-development program.☆

PREDICTING SOIL EROSION LOSSES

Soil losses caused by precipitation runoff are measured with these devices. Data taken is used in testing accurate, new Universal Erosion Equation that aids in estimating potential erosion losses.

A new way to forecast possible rainfall damage to farm land can help technicians plan more efficient cropping practices

Artificial rainmaker used in tests creates "storm," simulating real erosion conditions that account for loss of tons of valuable top soil.

■ How many tons of soil will wash out of a field in an average year?

This figure can be more accurately forecast through a new "equation" developed by USDA scientists and now being tested by Soil Conservation Service technicians in Tennessee. The scientists call the new formula the Universal Erosion Equation.

One factor in the equation takes into account energy and intensity of rain when it hits the ground. Others measure the effect of length of slope, percentage of slope, erosion control practice, erodibility of the particular soil, and different cover crop and soil management practices. Both the cover-soil management factor and the one that reflects energy and intensity of the rain have recently been reevaluated.

Through the equation's use, technicians will be able to predict the tons of soil that could be lost from a field and then prescribe what erosion-control and management practices must be followed to limit the loss to permissible levels.

Similar equations have been used since the early 1940's by technicians in the Corn Belt and in the Northeast, but this is the first attempt to make one that would be applicable nationally. It may permit more intensive cropping on land not suited for such use and prohibit the use of such cropping practices on other slopes where they have been permitted.

One reason for the accuracy of the new equation is the new factor dealing with rain energy and intensity—termed the rainfall-erosion index. Scientists had known for years that the force with which rain hits the ground varies in different parts of the country and even in different parts of the same State. But they had not been able to accurately measure its effect on soil erosion until W. H. Wischmeier, ARS analytical statistician, came up with the factor now being tested.

The work shows that the Southeastern States have the severest storms, but the worst ones come when cover is established. The erosion potential at Clemson, S.C., is nearly twice that at Lafayette, Ind., during an average year, but it is less than half that of Indiana during the highly vulnerable period between seedbed preparation and 2 months after planting. And although it is nearly four times higher than that at Geneva, N.Y., for the whole year, it is about equal with that of Geneva during this period in the spring.

Can plan best practices

By using this information, technicians in South Carolina know that farmers will gain from a winter cover crop because of the intensity of winter storms. Indiana would gain from such practices as minimum tillage, mulch planting, and soil conditioning by sod crops because of the intensity of storms near planting time.

The rainfall-erosion index is obtained by adding the products of individual storm energy in units of 100 foot-tons per acre and its maximum 30-minute intensity in inches per hour

over a continuous period of years sufficient to provide a normal annual figure. The sum, designated as EI (Energy-Intensity), provides a measure of the storm's capacity to produce erosion on a cultivated fallow area. Commonly occurring values of the EI term for individual erosion-producing storms range from about 1 to slightly more than 100.

The approximate range of the annual index in different parts of the country is as follows: Southeastern States, 190–440; Northeastern, 70–220; North Central, 90–260.

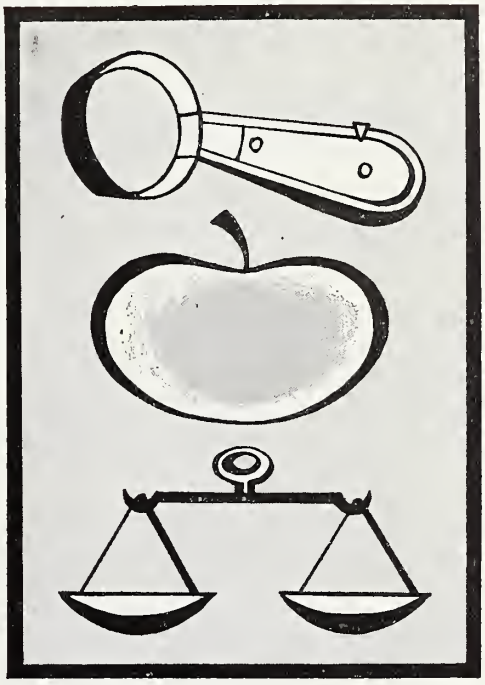
Publications are planned

This data will be made available for widespread use by a series of publications, the first covering the nine Southeastern States.

The protective effect of different crops in shielding the soil from rain is taken into account by the other re-evaluated factor—cover-soil management. This work was also done by Wischmeier. For example, he divided the growing season of corn into 5 periods with 44 relative erosion values for each period. The 5 periods are plowing to seeding date, seeding to 30 days, second 30 days after seeding, 60 days after seeding to harvest, harvest to plowing. The 44 values for each cover period represent different management practices, such as preceding crop tillage, residues, fertilizers, and the like. Similar values will be determined for other commonly grown crops.

Research is continuing in order to improve factors for expressing the effect of length and percentage of slope and the erodibility of each particular soil. It is part of continuing research to develop new knowledge and techniques of fighting soil erosion. When new values for these factors are determined they will be made available for use in a new Universal Erosion Equation.☆

SOON: BETTER CONTROL OF FRUIT SIZE



■ An improved way of thinning apples, peaches, and pears—and predicting harvest size of the fruit—may be available to Northwest growers in a year or two.

A chart is being devised to correlate early average weights of representative fruit with final size. (A random sample of 20 fruit from each of 5 trees per acre has been used in experiments, but this may be changed as the method is developed.) While use of the weight averages now appears most promising with apples, good preliminary results have been obtained with peaches and pears.

USDA scientists consider use of the weight averages a quick, practical supplement to a gage and chart now used by 2,000 to 3,000 Northwest apple and peach growers to determine thinning requirements and predict final fruit size. A movable metal band on the gage is placed around representative fruit to measure the diameter at specific times early in the season. Reference to the chart enables a forecast of fruit sizes at harvest. Thus, growers can direct thinning of small-size fruit that take up water and nutrients and tend to decrease the harvest size of desirable larger fruit.

ARS plant physiologist L. P. Batjer is heading the research at Wenatchee, Wash., in cooperation with the Washington Agricultural Experiment Stations. He expects to have more detailed information on the use of weight averages after next season. Batjer and his co-workers developed the gage and chart by correlating early growth patterns of fruit with final size.

He believes that use of the combined methods, adapted for operators of irrigated orchards in certain other parts of the country, could result in production of more premium-grade fruit. Irrigated trees, such as those in the Northwest, ordinarily set much more fruit than can mature into No. 1 quality. Discount prices are paid for small-size fruit that result from improper thinning of these trees. ☆

NEW IDEAS ON AN OLD SUBJECT

INSECT ERADICATION

Methods for achieving elimination of the fruit fly will be tested for cost and effectiveness on two Pacific islands

■ New methods of eradicating fruit flies will be field tested on small isolated Pacific islands by USDA entomologists. Small islands were chosen because their entire infected area can be treated easily and reinfestation can be controlled.

One promising method to be tested is sterile-male release. which bas proven so successful against the screwworm (AGR. RES.. July 1958. p. 8). Great numbers of flies made sterile by radiation will be dropped from planes to mate with native flies. Since the resulting eggs do not hatch. the new generation is much reduced. Continued overflooding with sterile males should eventually wipe out the flies.

In other tests, poisoned lures to attract and kill males will be distributed a week or more before the flies attain sexual maturity. Continued use of this method also promises annihilation.

The entomologists will measure fly populations by trapping and holding host fruits for larval development and determine when insect numbers are lowest—the most advantageous time to attack. This will probably be before host fruits and vegetables ripen.

After the tests the different methods will be compared as to cost, effectiveness. and feasibility.

The United States Navy and the Trust Territory of the Pacific Islands will cooperate by lending planes, boats, personnel. and facilities.

Rota in the Mariana Islands was chosen for the sterile-male-release experiment by entomologists E. F. Knipling, L. D. Christenson, and L. F. Steiner. The island has an area of nearly 33 square miles and the nearest land—Guam—is 30 miles away. Pupae produced and sterilized in the laboratory will be distributed on Rota by plane. Expectations are that oriental fruit flies will be released at a rate of 2 million a week and melon flies at 1 million a week—the releases to continue for at least a year.

The researchers will determine how near they are to eradication by collecting and holding hosts for fly emergence. releasing marked sterile flies, dissecting trapped females to see if they contain eggs. exposing preferred hosts or ovipositional devices (objects on which flies lay eggs). planting of preferred host trap crops, and other practical means.

The sterile-male release experiment requires a constant adequate supply of sterile flies. At the Honolulu Laboratory low-cost methods and facilities developed by University of California and USDA entomologists are making possible streamlined rearing and radiation. In the cobalt 60 unit about 50,000 puparia can be irradiated at a time (AGR. RES., December 1957, p. 11). Dosage has to be measured accurately to make the fly sterile but not interfere with normal mating habits.

The male-annihilation test will take place on the Bonin Islands, whose 27 square miles total land area is covered with dense tropical vegetation. Poisoned lure will be distributed at 2-week intervals. In non-inhabited areas the lure will be applied to pieces of fiberboard, paper. or plastic and discharged by plane. In residential areas. the lure will be distributed on permanent fiberboard bait stations from the ground. ☆

IN THE FUTURE

Treating insects so they will destroy their own kind is the aim of research suggested by USDA entomologist E. F. Knipling. He believes that there may be even more effective ways to control pests than the sterile male technique which has been used successfully in eradicating screwworms in Florida, Georgia, and Alabama, and is now being tested with fruit flies.

Knipling suggests researeh along three lines: (1) Development of chemical compounds that will produce sexual sterility in both males and females in natural populations; (2) finding ways to contaminate or infect insects with diseases that will spread among their kind; and (3) breeding defective insects that will produce inferior progeny unable to survive.

First, however, more basic information is needed about insects—their nutrition, mating habits, and other factors. Then any promising methods developed will have to be tested for practical effectiveness.

A chemical causing sterility of the natural population could be used without the difficulties encountered in using males made sterile by radiation. It would also be more effective than insecticides. For example, in a population of a million insects multiplying 5 times in each generation. an insecticide that kills 90 percent of each generation would leave 125,000 still alive after the third generation. But a chemical that would produce 90 percent sterility without affecting sexual behavior would leave only 125 alive.

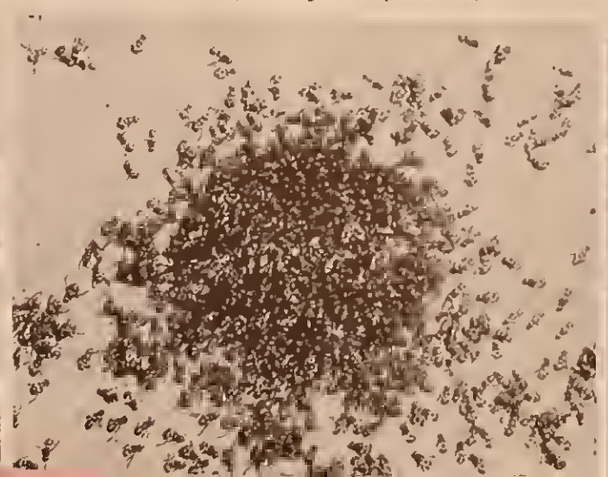
Spreading disease by releasing infected insects should also give better control than irradiation, especially among multiple-mating species. A diseased male could destroy the reproductive capacity of several females if the organism is transmitted to all females with which he mates. Also diseased progeny and infected adults might further spread the disease.

The adverse effects on longevity and mating vigor caused by sterility-producing radioactive rays on certain multiple-mating insects makes it necessary to release about 900 sterile males to reduce a natural population of 100 insects per acre by 75 percent. However, the same result would be achieved by 55 diseased insects if mating and infection of mates took place an average of three times.

The third method suggested—breeding defective insects—would produce insects and progeny that could not survive. For example. the inability of a boll weevil to fly would not interfere with its production in the laboratory nor with its mating when released in cotton fields, but it would lead to the death of all progeny so affected because they could not fly to hibernation areas in the fall or to cotton fields in the spring. ☆

In male annihilation test poisoned bait is applied to absorbent cane fiber board with pump-type oilers. Such bait stations are used in residential areas.

Male oriental fruit flies are attracted by methyl eugenol and killed by poison mixed with it before they can mate with females. Attractant is placed so that prevailing winds spread odor.

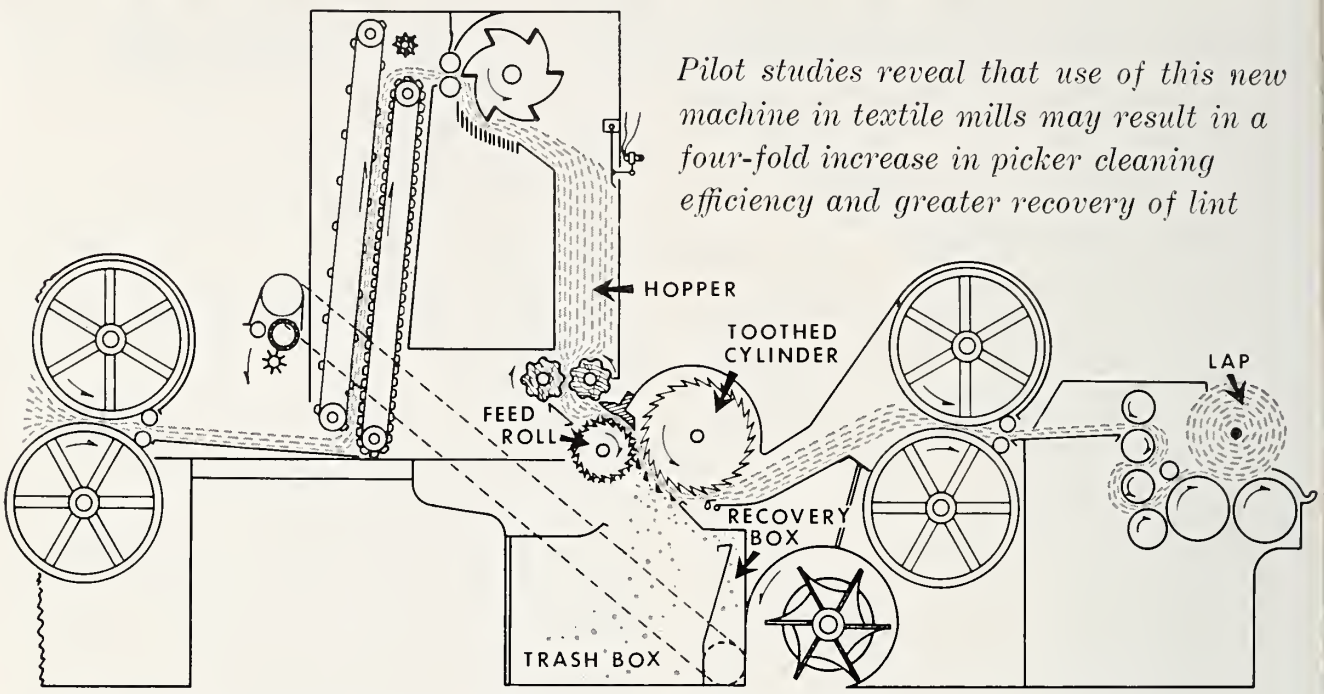


Irradiation is applied during pupal stage. Dosage should produce sterility without interfering with fly normal mating habits.

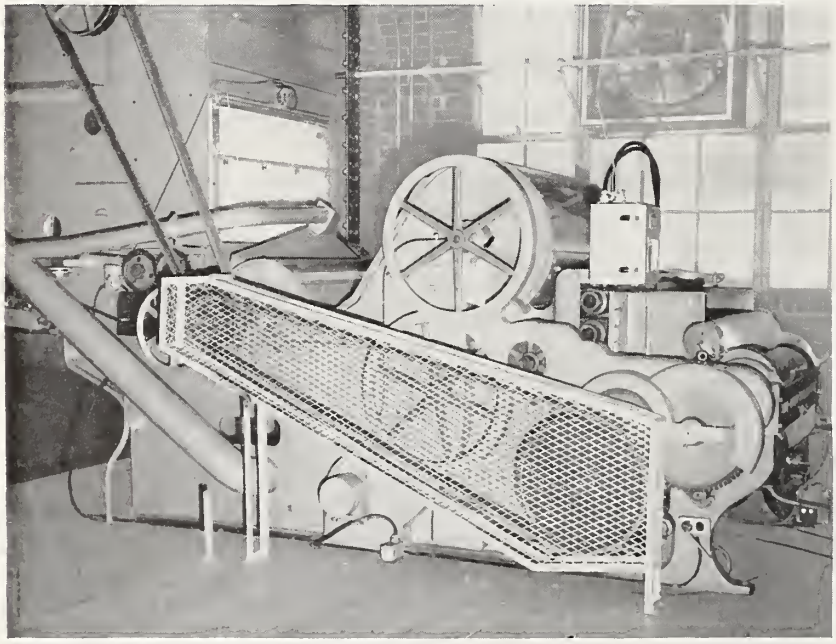
Effective, economical mass-rearing methods are essential for producing the number of flies needed to overflood wild populations.

CLEANER COTTON, LESS LOSS

Pilot studies reveal that use of this new machine in textile mills may result in a four-fold increase in picker cleaning efficiency and greater recovery of lint



Route of lint cotton through new SRRL carding cleaner is shown by dotted lines. Traveling from left to right, the cotton enters hopper and is removed by feed roll. Little tufts of cotton are pulled from the feed roll by the toothed cylinder. Trash falls into box, while clean lint moves on in layer and is formed into a lap (rolled sheet). Lint usually wasted because it falls in trash box is sucked into recovery box and is returned through the tube, marked by dashes, for reprocessing. The new cleaner (see photo below) was designed by ARS utilization engineers through revamping of finishing section of one-process textile picker.



■ More efficient cleaning of cotton is possible with a new machine developed by USDA. And much lint usually lost can be reclaimed.

Called the SRRL carding cleaner, the unit was designed by ARS engineers of the Southern utilization division, New Orleans, for use at textile mills in preparing ginned lint for spinning into fabrics.

In pilot studies, the carding cleaner removed an average of half the trash left in cotton after preliminary cleaning, blending, and fluffing of lint from bales. (This initial processing often is done at textile mills with an SRRL opener or SRRL opener-cleaner. An aerodynamic cleaner recently was introduced as an attachment for these machines and greatly increases their

cleaning capacity. See AGR. RES., February 1960, p. 10. The aerodynamic cleaner, opener-cleaner, and opener were also produced at New Orleans by USDA engineers.)

The carding cleaner was devised by G. J. Kyame and W. A. Latour, under the direction of R. A. Rusca, by complete revamping of the finishing section of a standard one-process textile picker. These improvements resulted in a four-fold increase in picker cleaning efficiency.

Recovery system saves lint

In addition, the carding cleaner reduces lint loss to about a third of that resulting from use of standard textile pickers. The saving is effected by a recovery system in the trash box on the new cleaner. Free lint is sucked through an opening into a recovery box and sent back through a tube for reprocessing.

As a unit, the standard picker and new carding cleaner do two jobs. They clean cotton as much as possible without excessive handling and convert the fluffed-up mass into a thick flat sheet (bat or lap) that is rolled up for more processing. These rolled sheets are more even textured and better felted than those processed by standard pickers alone.

Licenses available from USDA

Compared with a standard picker, the new carding cleaner processed cotton with no significant differences in the number of tiny knots (neps), or in such fiber or yarn properties as strength or elongation.

Details on the SRRL carding cleaner are available to industry, and nonexclusive licenses to manufacture the machine in the U.S. on a royalty-free basis can be obtained from the Secretary of Agriculture.☆

Water does not pass through treated cheesecloth and remains for months without wetting threads.

New Fabric Treatment Repels Water

■ A new water-repellency treatment developed by USDA chemists for use on various cotton fabrics has proved efficient in laboratory tests.

The treatment is done with an alloy of two silicon compounds, tetravinyl silane and methyl hydrogen siloxane, and it does its job so well that a 2.5-percent addition of the alloy gives water repellency equal to that produced by a 3 to 5-percent addition of chemicals ordinarily used for this purpose. Scientists at the ARS Southern utilization division, New Orleans, developed the new treatment.

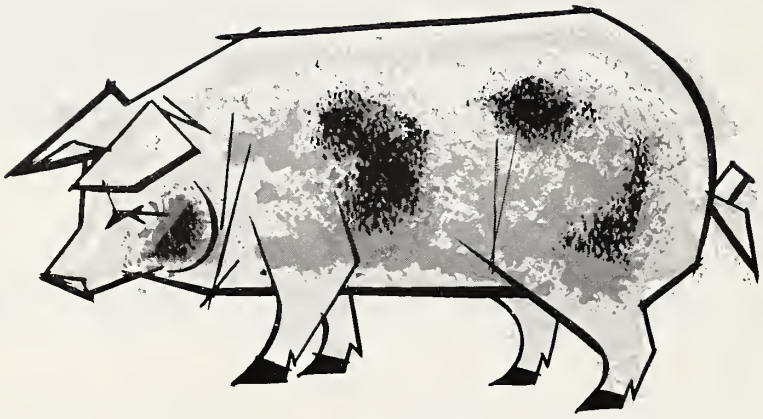
This high degree of efficiency is achieved without sealing the pores of the treated fabric, making it highly desirable for rainwear or other wearing apparel where air permeability as well as water repellency is desirable. This property is vividly illustrated by a laboratory test in which water was poured on a sample of treated cotton cheesecloth. The water remained on the cheesecloth for months without passing through the openings of the fabric, or wetting the threads. The treatment has also been used successfully on cotton broadcloth, 80-by-80 print cloth, and other lightweight cotton fabrics, as well as the heavier types commonly used in rainwear.

Silicons are extensively used in the textile industry as fabric softeners, and this silicon alloy produces a similar effect. The new treatment improves resistance to flex abrasion and increases the tear strength of fabric, although the breaking strength is reduced somewhat. The treatment has the added advantage of improving crease recovery of wrinkle-resistant fabrics.

Originally developed for use on cotton fabrics, the silicon alloy is also effective on fabrics from other fibers, such as wool.

The treatment can be applied from either an aqueous emulsion or an organic solvent, with equipment commonly used in textile finishing, and is compatible with treatments to impart other desirable properties, such as flame resistance and crease resistance.

It is estimated that the cost will be low enough to be commercially attractive. ☆



Limited Feeding Means More Efficient Hogs

Controlling feed intake of growing pigs lowered amount and cost of feed for each pound of gain, yet produced low-fat, high-meat carcasses desired by most consumers

■ Evidence seems to indicate that slightly hungry pigs are generally more productive than better-fed pigs.

Three-year Wisconsin-USDA tests show that we can substantially reduce a gilt's feed intake during early growth and gestation without reducing the size of the litter farrowed or without hurting nursing ability. Moreover, pigs on restricted diets had the most desirable carcasses—with least backfat and most lean meat. And, of course, feed costs are lowered with small feed intake.

These findings tend to back up the current practice of limiting feed intake and growth rate to produce the lean look in pigs for a low-fat high-meat type carcass.

This project is part of research by the Wisconsin Agricultural Experiment Station in cooperation with ARS on the Upper Mississippi Valley Soil Conservation Experiment Station at La Crosse, Wis. Work was done by Wisconsin animal husbandmen H. L. Self (now with Iowa State University), R. H. Grummer, and H. G. Spies, and ARS soil scientist O. E. Hays.

Overall aim is to provide information on soil and water losses and on certain production problems when swine are pastured at different intensities on steep slopes. Most recent aspect of the study, however, dealt only with the influence of different feeding levels during growth and gestation on reproduction, weight gains, and carcass quality.

Ninety weanling pigs were grown out on three levels of feed intake on alfalfa-brome-ladino pasture. One group of animals ate all they wanted, another got approximately two-thirds the daily intake of animals in the first group, and a third group went a little hungry, eating roughly about one-third the feed intake of the first group. Average daily gain, daily feed intake, and feed efficiency were computed from the beginning of the pasture season to market weight. The pasture was completely adequate at all times.

Less feed per pound of gain

You'd think that the biggest and best-fed pigs would yield the leanest meat and the best-fed gilts, the biggest litters. But this wasn't so. The least-fed animals did better on most counts. Here's what the scientists found:

The best-fed animals gained 1.59 pounds daily on 5.29 pounds of feed, giving a feed efficiency of 3.33 pounds of feed per pound of gain. Animals getting along on moderate feed intake gained 1.38 pounds daily on 4.32 pounds of feed, for a feed efficiency of 3.13. And the animals on the smallest amount of feed gained 1.23 pounds daily on 3.54 pounds of feed for a feed efficiency of 2.88.

Differences in grazing intensity due to differences in lot size apparently had no effect on any of the traits studied.

Pigs in the two limited-fed groups gained an average of 170 pounds each while on pasture, a total gain of 4,080 pounds per acre for the medium-fed group, and 2,720 pounds per acre for the least-well-fed group.

Compared to the feed-conversion rate in the full-fed group, there was a saving of 0.20 pound of feed per pound of gain for moderately-fed hogs. This amounted to saving 816 pounds of feed per acre. For the least-well-fed hogs, the saving was 0.45 pound of feed per pound of gain, or 1,224 pounds per acre.

Value of pasture increased

Thus, if feed costs are estimated at $60 per ton, the pasture was worth $24.48 per acre more when hogs were restricted to moderate feed. For least-well-fed animals, the pasture was worth $36.72 per acre more.

This is a saving in feed cost of about $1 per moderately-fed pig and about $2.30 per least-well-fed pig. If the additional 4 to 6 weeks needed for these latter pigs to reach market weight should occur on a declining market, obviously, the saving would be smaller or even nullified.

Feeding level also had a marked effect on the carcasses of pigs selected for slaughter from each of the groups. Pigs getting the least feed averaged lowest in backfat thickness and highest in yield of lean cuts. Loin eye area, however, didn't seem to be affected by the nutritional level, suggesting that this trait is harder to change by altering management practices than is backfat thickness or yield of lean cuts.

Least-fed gilts weigh less

Gilts saved for breeding differed significantly in weight at breeding. Full-fed gilts averaged 480 pounds; moderately-fed gilts, 427 pounds; and least-well-fed gilts, 365 pounds.

The lightest-weight dams averaged 1.1 more pigs per litter at both birth and at weaning than the heaviest dams. Dams of intermediate weight averaged 0.8 more pig per litter at birth and 1.1 more per litter at weaning than the heaviest dams.

In addition, lighter-weight dams weaned heavier litters, although the individual pig weights from these litters were somewhat lower.

Fewer pigs from heavy gilts

These results definitely show that, contrary to popular belief, the heaviest dams at farrowing don't necessarily produce the largest litters or raise the largest number of pigs.

The ability of the gilts kept on limited feed to perform as well or better than the full-fed gilts indicates that obtaining bigger and heavier gilts isn't necessarily advantageous and may actually be detrimental to reproductive efficiency.☆

OUR SEARCH FOR A BETTER JOHNE'S DISEASE VACCINE

■ A vaccine that could control Johne's disease and *not* interfere with our nationwide tuberculosis eradication program isn't a reality yet. But long-range USDA work is uncovering many facts which should some day help to achieve control of this puzzling disease (AGR. RES., April 1958, p. 11).

Details of the allergic response in calves were studied in the most recent work at the ARS Regional Animal Disease Research Laboratory, Auburn, Ala.

Some vaccines against Johne's disease appear to provide serviceable immunity. But, unfortunately, the vaccinated animals tend to give false positive reactions to the tuberculin test, indicating that they have tuberculosis when they really don't. Scientists are aiming for a vaccine that would protect *young* cattle, which are highly susceptible to Johne's disease. It makes little difference if immunity is lost when the animals are older, as they are then better able to resist infection.

ARS veterinarians A. B. Larsen and T. H. Vardaman of the Auburn station recently found that 20 months after vaccination against Johne's disease, sensitivity to the tuberculin test had disappeared in some animals and was low in others. Eight of 15 animals experimentally vaccinated against Johne's disease would have been classified as negative to the tuberculin test; the rest of the animals showed small reactions.

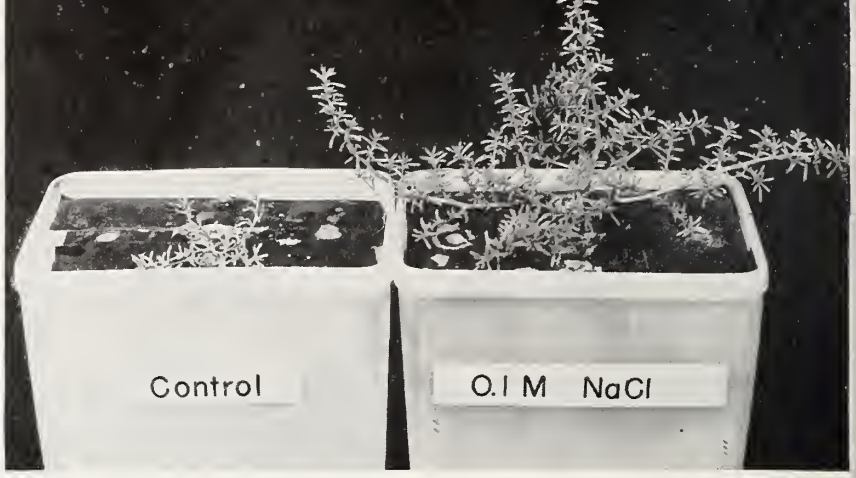
Removing the nodules at the point of vaccination didn't reduce the sensitivity of animals to either the tuberculin or johnin sensitizing agent. And the *amount* of vaccine used in these experiments had almost no effect on the degree of persistence of the allergic response to the tuberculin and johnin tests.

Reactions measured in sensitization studies

Reactions to johnin were larger than reactions to tuberculin in most tests. The differences were more pronounced in tests made on the cervical region than in those made on the caudal area. When some animals were later sensitized to tuberculosis, however, the tuberculin reactions were larger than the johnin reactions in most cases. The differences were more pronounced in the cervical region than in the caudal fold. ☆

Progress in Halogeton Control

Small areas of this weed are stopped by chemicals, but we need better range treatment



Halogeton plant (left) given minerals normally essential to plants makes poor growth in comparison to plant (right) also supplied with sodium chloride in 0.1 molar solution.

■ How can we get rid of halogeton, the pernicious weed that's fast spreading and poisoning our sheep on our Western range?

This weed, well adapted to dry, alkaline soil, has taken over an estimated 10½ million acres since 1934.

Cooperative USDA-State research shows we can prevent spread of halogeton from limited areas with chemical treatment. Reseeding of desirable plants, where possible, will also reduce stands of halogeton. And USDA entomologists overseas are continuing the search for natural enemies of halogeton (AGR. RES., April 1957, p. 11), with investigations now centered in Morocco. But we don't yet have an economical method of control for the range at large.

One reason for halogeton's invasion of our deserts is its adaptation to soils with a high salt content. Most desert-adapted plants are *tolerant* to the salt. But ARS plant physiologist M. C. Williams, cooperating with the Utah Agricultural Experiment Station at Logan, found that sodium chloride is *essential* for vigorous growth of halogeton. In cooperative research in Idaho, the number of plants increased with increasing soil salinity. The reverse was true for crested wheatgrass, Russian thistle, and other forage plants.

Another characteristic that suits halogeton for desert growth is rapid germination of the plant's black seeds under low moisture conditions. This annual weed also produces brown seeds, which are believed to remain dormant for years. Scientists in Idaho, Nevada, Utah, Washington, and Wyoming have begun a 10-year longevity study of the two types of seed at various soil depths.

Chemical control is complicated because plants are susceptible to herbicides only at certain stages of development, and plants continue to emerge from seed after treatment. Herbicides also injure or kill desirable desert shrubs. But chemical control has proved feasible for new and isolated infestations that threaten large, halogeton-free areas, and for infestations along sheep driveways, holding areas, and roadways on the edge of large infestations. Agronomists H. L. Morton, R. H. Haas, and W. C. Robocker, and plant physiologist E. H. Cronin, of ARS, and agronomist L. E. Erickson, of the Idaho Agricultural Experiment Station, developed the control methods in Idaho, Utah, and Nevada.

The recommended spray, selected from experiments with over 40 compounds, is a low-volatile ester of 2,4-D (2,4-dichlorophenoxyacetic acid), applied at the rate of 2 pounds acid equivalent per acre, diluted in 15 gallons of water. The weeds must be sprayed at the cruciform stage—when four horizontal branches forming a cross have developed—but before upright branching begins. In Idaho, this stage is reached about June 15. Three weeks later, just when flowering begins, the treated area must be checked and all surviving and newly developed plants resprayed, hoed out, or pulled. The area must again be checked before plants produce seed—in late July or early August—and if necessary, sprayed with a solution of 4 pounds of low-volatile ester of 2,4-D, plus 1 quart of DNBP (4,6-dinitro-ortho-sec.butylphenol) and 15 gallons of diesel oil, per acre. All stems must be killed to insure that no seeds are produced.

Studies show pre-emergence treatments with 2,3,6-TBA (2,3,6-trichlorobenzoic acid) have great promise for small areas. If herbicides were applied in late fall or early winter, they might do a minimum of damage to forage species (then leafless and semi-dormant)—yet have a residual effect on halogeton, which begins to germinate as early as January. ☆

DHIR is fourth plan

A new way for Dairy Herd Improvement Associations to handle breed registry production records brings U.S. dairymen closer to uniform recordkeeping. The new system is now part of the USDA-coordinated National Cooperative Dairy Herd Improvement Program.

Known as the Dairy Herd Improvement Registry, the new method essentially is the Standard DHIA electronically computed record plus a few additional features. The new setup should end confusion caused by different methods of keeping records.

DHIR increases to four the number of recordkeeping plans in the National Cooperative Dairy Herd Improvement Program. Others are Standard DHIA, Owner-Sampler, and Weigh-a-Day-a-Month. This cooperative effort has contributed much to lowering milk production costs and improving herds for 50 years.

The DHIR plan is a result of several years of cooperative study by the American Dairy Science Association's Records and Breeds Relations Committees, Purebred Dairy Cattle Association's Testing Committee, and breed registry groups.

New utilization staff

A new Product and Process Evaluation Staff will study the market potential and industrial practicability of processes and products recommended for development by USDA's Utilization Research and Development Divisions.

This technical group fills a long-recognized need for devoting increased attention to factors concerned with the size of new markets and possible use of new processes.

J. R. Matchett, formerly assistant to the ARS administrator for utilization research and development, is director of the unit and will be assisted by four specialists—one each for chemicals, foods and feeds, fibers, and the study of commodities.

The unit will analyze situations and make recommendations in terms of utilization research goals. The staff will make full use of statistical and other data already being compiled by Federal, State, and private agencies.

Restrictions lifted

Farm animals can now be moved more freely from Florida to other States. Shipping restrictions imposed in Florida because of the screwworm have been lifted by USDA as a result of progress in eradicating this livestock parasite in the Southeast.

Shipping requirements for livestock moving from California, New Mexico, and Arizona into the Southeast eradication area now apply on a year-round rather than 7-month basis. A survey confirmed that the screwworm overwinters in these three Western States. Year-round regulations still apply to livestock movements from Texas and Louisiana into the eradication area of Florida, Georgia, Alabama, South Carolina, and Mississippi.

Regulations on livestock movements became effective in September 1958 to prevent interstate spread of the pest and facilitate a Federal-State eradication program in the Southeast. No livestock infested with screwworm were permitted to be moved interstate for any purpose.

No cases of screwworm infestation have been reported in Florida since mid-June 1959. Before the cooperative eradication plan went into effect in July 1958, up to 40,000 cases a month were reported. Screwworm facilities in Sebring, Fla., are now on a standby basis. Officials urge livestock owners to submit suspected larval specimens for identification to the Survey Data Center at Sebring.

Long-lived hoppers

Although most grasshoppers complete their life cycle in 1 year, some species in high altitudes of the Rocky Mountains require 2 and 3 years for development, USDA entomologist J. B. Kreasky discovered.

This long developmental period explains the erratic results obtained in some Wyoming grasshopper control work, when many reinfestations occurred the year following spraying.

In the study of life cycles of 4 grasshopper species, eggs laid in the soil at 8,500 feet elevation were allowed to remain 2 years. Eggs were incubated in the laboratory the second summer, but only the *Melanoplus borealis* Fieber eggs hatched completely and about half the *M. bruneri* Scudder eggs hatched. The unhatched eggs of *M. bruneri*, *M. alpinus* Scudder, and *Chorthippus longicornis* Latreille contained fully developed embryos in diapause (a period of arrested development).

To simulate a third cold period, unhatched eggs were kept in a refrigerator at 37° F. from July to Novem-

ber. When reincubated, all eggs hatched within a few days, showing that *M. alpinus* and *C. longicornis* and sometimes *M. bruneri*, require three cold periods for development.

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Bunchgrasses may return

Two valuable perennial bunchgrasses—once abundant but now scarce in the West—may return as forages. USDA scientists are trying to develop strains of Indian ricegrass and green needlegrass whose seed will sprout instead of remaining dormant.

Indications are that the new strains can be developed without the characteristic of seed dormancy, says ARS agronomist G. A. Rogler.

Overgrazing greatly reduced stands of the grasses. Ranchers were unsuccessful in restoration because most of the seed remained dormant.

Tests at the Northern Great Plains Field Station, Mandan, N. Dak., showed that various strains of the grasses have different seed dormancy characteristics. These strains are being crossed in efforts to select for increased germination. However, dormancy decreased as seed aged. For example, 7-year-old green needlegrass seed averaged 71 percent germination, but seed a year old averaged only 26 percent germination.

Moist-chilling or scarification of the seed with acid increase germination, but these methods are cumbersome, costly, sometimes dangerous, and not always successful.

Indian ricegrass grew extensively on arid and semi-arid ranges in the West and Canada. A palatable, nutritious forage, it was grazed in summer and winter. Green needlegrass grew widely on the central and northern Great Plains. It is palatable, nutritious, has good seedling vigor, and yields well.

Four lettuces released

Seed of four new lettuce varieties—Vanguard, Golden State C, Golden State D, and Climax—is available from commercial sources. The new varieties were released recently by USDA and the California Agricultural Experiment Station.

Vanguard is a distinctly new type of high quality. It is large, dull green to the base of the leaves, slow maturing, and tipburn resistant. It has fine head conformation and is free of ribbiness or any tendency to be "spidery."

Climax is high quality, large, thick leaved, fairly slow bolting, and tipburn resistant. It is well adapted to the Imperial Valley of California, for the winter crop, and may have considerable range of season. It grows larger heads and holds color better than leading winter varieties now grown in the area.

Golden State C and D are similar to sister varieties released a year ago. Like these, they have good eating qualities, creamy-colored interior, large head, and dark-green crisp leaves. They are slow bolting and tipburn resistant. Both are adapted to the Salinas, Calif., area.

Disease-resistant tobacco

NC 75 is a new flue-cured tobacco variety that is resistant to several diseases and has various other desirable characteristics.

USDA and the North Carolina Agricultural Experiment Station recently released the new variety. Certified seed growers are increasing stocks for planting by farmers in 1961.

NC 75 is highly resistant to black root rot and moderately resistant to black shank and fusarium wilt, and was injured less by brown spot than some leading commercial varieties grown in 1959. It showed some resistance to Granville wilt in field tests, but greenhouse-grown seedlings were injured.

The North Carolina station, North Carolina Department of Agriculture, and ARS developed NC 75 cooperatively from crosses of Dixie Bright 102, Bottom Special, and Beltsville 1–76. NC 75 was evaluated in regional tests from Virginia to Florida.

The new variety yields about 9 percent more than Hicks Broadleaf or NC 73. Cured leaves of NC 75 rated just above those of NC 73 and some-

what under Hicks Broadleaf in appearance. NC 75 was classed slightly below both varieties in flavor and aroma. Growth characteristics of the new variety are good.

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